Evaluation and Improvement of Physical Education in Colleges and Universities Based on Ahp Level Analysis

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Abstract: the College Teachers Are the Main Body of Knowledge Dissemination, Scientific Research and Technological Innovation, and Play an Important Role in National Development, Personnel Training, and Scientific and Technological Progress. This Paper Uses the Tomographic Analysis Method to Determine the Weight of the Established Index System and Adopts the Fuzzy Comprehensive Evaluation Method to Model the Problem, So as to Solve the Problem That the Qualitative Index Cannot Be Quantified in the Index System. Finally, 41 Professors from a Certain University Were Selected to Use the Index System to Conduct Experiments. Combining Theory and Example Analysis, the Established University Teacher Performance Evaluation System and Fuzzy Comprehensive Evaluation Method Are Applicable to the Performance Evaluation of University Teachers. This Can Solve the Problems of over-Subjectivity and Other Disadvantages of Traditional University Teacher Performance Evaluation to a Certain Extent, and Improve the Quality of Education and the Level of Running a University.

1. Introduction

The Focus of Market Competition in the 21st Century is on Talent Competition. Human Resources Are the First Resource of Modern Economy and Society. Economic Growth Depends on Knowledge Innovation and Talent Quality [1]. Therefore, under the Increasingly Fierce International Competition Environment, the Development of Economy, Science and Technology, and the Development of the Country and Society All Urgently Require Highly Qualified Personnel [2]. the Policy of Enrollment Expansion in Colleges and Universities Promotes the Development of the Training of High-Quality Talents. At the Same Time, the Guarantee for the Quality of Talents Should Also Be Given Adequate Attention. the Quality of Teaching Directly Depends on the teachers' Educational Ability and Dedication. It Can Be Said That the Quality of Teaching Depends on the Teaching Ability and Enthusiasm of Teachers [3]. College Teachers Are the Main Body of Knowledge Dissemination, Scientific Research and Technological Innovation, and Play an Important Role in National Development, Personnel Training and Technological Development[4]. Since Our Country Promulgated the "Teacher Law" in 1993, It Has Clearly Stipulated That a Teacher Certification System and a Teacher Appointment System Should Be Implemented. Teachers Can Obtain Teacher Qualification Certificates Only through Rigorous Testing and Assessment, and the Employment of Teachers Will Be Linked to Their Performance. the Development History of Performance Evaluation Has Been Very Long. from the Beginning of Human Production Activities, It is Accompanied by a Budding State of Performance Evaluation. with the Continuous Deepening of the National Policy on the Reform of Higher Education, the Reform of the Personnel System in Colleges and Universities Has Also Achieved Certain Achievements. the Personnel Assessment Has Generally Begun to Change and Develop in the Way of Performance Evaluation [5]. However, Due to the Relatively Short Time for the Study of the Theory of Teacher Performance Evaluation in China, the Performance Evaluation of University Teachers Still Has Many Deficiencies.

2. State of the Art

China's college teachers' performance evaluation research started relatively late compared with

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foreign countries. It was first produced after the Cultural Revolution in the 1960s. The national education system reform promoted the development of teacher performance evaluation [6]. Based on the study of teachers' performance evaluation in foreign countries, the development of our country's research is fast. Especially in recent years, with the gradual development of higher education and the country's emphasis on higher education, the performance evaluation of university teachers has received more and more attention from educators. Scholars have also significantly increased their research literature on university teacher performance evaluation. On the basis of research on the evaluation of foreign teachers' performance, the research viewpoints in China generally hold that the purpose of evaluation should pay more attention to development evaluation and try to diversify the evaluation methods. The evaluation method should be combined with quantitative and qualitative. The evaluation should be "people-oriented". According to the teacher's personal interests and hobbies, distinguish the teacher's evaluation criteria and enrich our teacher evaluation system. The literature proposes an evaluation index system from three aspects: professional ethics, teaching work, and academic research. It also considers that it is necessary to further improve the teacher evaluation mechanism in China so as to make the evaluation process of college teachers in our country more scientific [7]. The literature pointed out that there are many problems in the current evaluation system for university teachers in China, such as unclear understanding of the purpose of evaluation, unreasonable selection of evaluation methods, disjointed teacher evaluation system and student evaluation system, etc [8]. A large amount of literature points out that China should establish clear evaluation goals, formulate suitable evaluation criteria, and select appropriate evaluation plans. The establishment of an effective incentive mechanism corresponds to it and ultimately gives full play to the role of the teacher evaluation system.

3. Methodology

3.1 Fuzzy comprehensive evaluation algorithm based on neural network

Neural networks, also called artificial neural networks or neural calculations, can be seen as abstractions and modeling with the human brain or biological neural networks, adapting to the environment and learning environment in a way that simulates biological interactions. It is an important part of artificial intelligence science and can solve all kinds of complicated problems that cannot be solved by manpower. The three main parts that make up a neural network are neurons, network topology, and training algorithms. A neural network can be seen as a parallel processing system that is formed by connecting a large number of neurons or nodes to each other. The structure and function of a single neuron seem to be simple, but the system formed by the connection of multiple neurons presents a distributed form of storage. Just because of this feature, the self-learning ability of the neural network is very strong and the fault-tolerance rate is high. The structure of the neuron is shown in Figure 1.

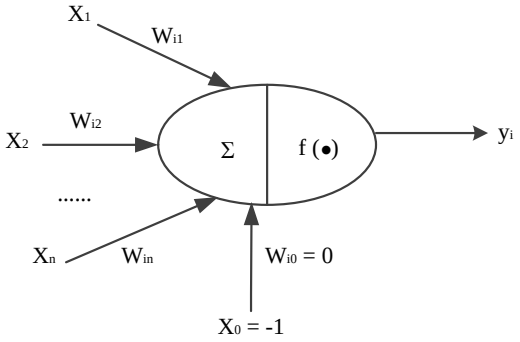

Figure 1 Neuronal structure

In which $x_1 — x_n$ represents the input signal of the neuron w_{ij} represents the connection weight between the neuron j and the neuron i, e represents the threshold (also called bias) and the

input and output relation expression of the neuron i is:

$$net_i = \sum_{j=1}^{n} w_{ij} x_j - \theta \qquad y_i = f(net_i) \tag{1}$$

The output of neuron i is A, net is called net activation, and function f is called activation function. If the threshold is regarded as the weight w_{i0} of some input x_0 of neuron i, the formula 1 can be simplified as:

$$net_i = \sum_{j=1}^{n} w_{ij} x_j \qquad y_i = f(net_i) \tag{2}$$

If you define X as an input vector and define W as a weight vector, then:

$$X = [x_0, x_1, x_2, ..., x_n] \tag{3}$$

$$\omega = \begin{bmatrix} \omega_{i0} \\ \omega_{i1} \\ \omega_{i2} \\ \cdot \\ \cdot \\ \cdot \\ \omega_{in} \end{bmatrix} \tag{4}$$

The output of the neuron can then be converted into a product of vectors:

$$net_i = X\omega \qquad y_i = f(net_i) = f(X\omega) \tag{5}$$

3.2 Fitness Running Exercise Model

The differential equations in (1) are adapted to the construction of college and community travel resource sharing platform. This model describes the nonlinear change process of the movement response speed of travel bodybuilders. Among them, $x_1(t)$ can be regarded as the heart rate change caused by exercise, that is, the increase of heart rate under calm state. u(t) represents the speed of movement at t. $x_2(t)$ can be described as the degree of fatigue, and fatigue is a series of complex physiology behind the movement, such as the vasodilation of active muscles results in lower arterial blood pressure, accumulation of metabolic by-products (such as lactic acid), sweating, or hyperventilation. $x_2(t)$ includes all of these factors. Parameter a_1, a_2, a_3, a_4 and a_5 take positive value. These five parameters represent each person's movement during the running. They vary from person to person and are uncertain. Figure 2shows a typical model representation depicting the changes in heart rate gain and fatigue as a function of speed.

$$\begin{aligned} x_1'(t) &= -a_1 x_1(t) + a_2[x_2(t) + u^2(t)] \\ x_2'(t) &= -a_3 x_2(t) + \phi(z(t)) \\ z(t) &= x_1(t), \phi(z(t)) := \frac{a_1 x_1(t)}{1 + \exp[a_5 - x_1(t)]} \end{aligned} \tag{1}$$

All heart rates in this paper are taken at 74 beats/minute by Cheng and Scalzi et al.

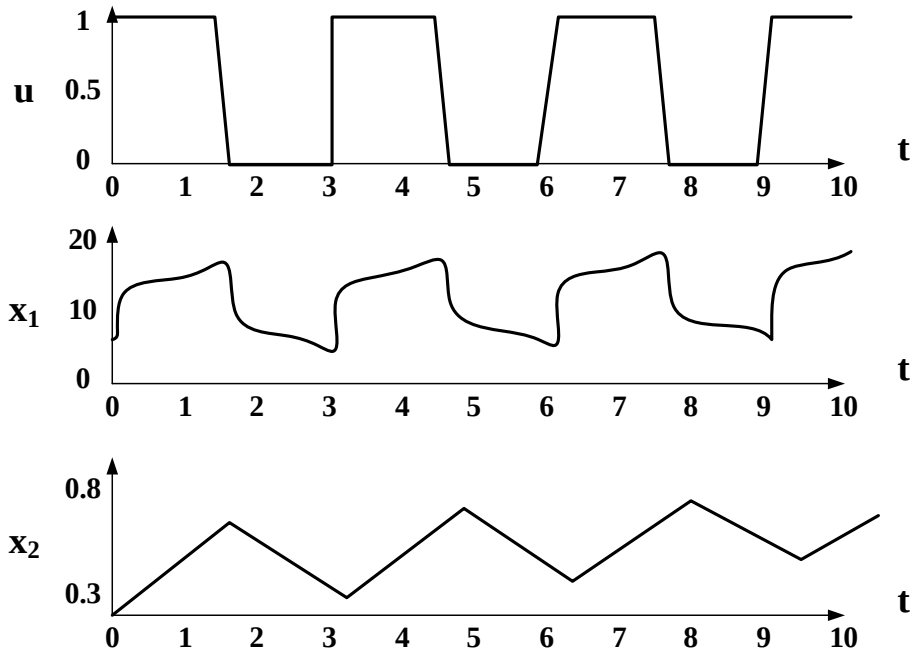

Figure 2 Typical reflection of model

Based on the structure of the fitness running exercise model, it is necessary to solve the five values of $a_1 \sim a_5$ to be estimated to determine each person's movement model. The value of the parameter is determined by each person's input and output time series. The input is the speed data $u(t)$. The output is the heart rate increment $x_1(t)$. Since the degree of fatigue cannot be measured directly, this forms a closed-loop nonlinear system. Cheng and Scalzi et al. used the Levenberg-Marquardt optimization algorithm to estimate the parameters. The sum of the squared difference between the heart rate delta obtained from the model and the measured heart rate delta was used as an evaluation index. The estimated value of the parameter should minimize the index.

4 Result Analysis and Discussion

According to the results of the fuzzy comprehensive evaluation, all participating teachers are ranked, and the assessment results are distributed according to the proportion. For example, in this example, the first 15% is selected as excellent, 55% is good, 25% is qualified, and 5% is unqualified. Therefore, the performance appraisal results are shown in the following table and figure below:

Tab.1 Results of the performance evaluation of 4 professors in a university

Teacher	overall ratings	Assessment results
Faculty 2 Teacher C	60.42	excellent
Faculty 11Teacher B	64.31	excellent
Faculty 4 Teacher B	63.51	good
Faculty 10 Teacher A	60.63	good

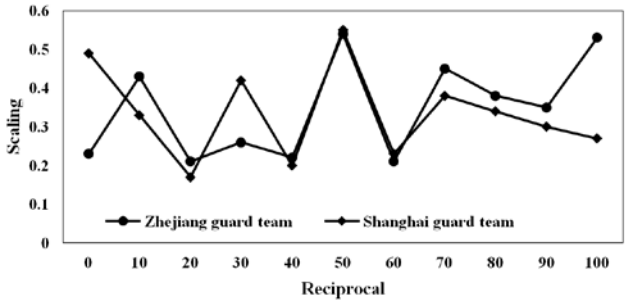

Figure 3 Adjacent judgment value

Based on the results of teacher performance appraisal, analyze the performance of each department. The analysis of the performance of each department is conducive to the mastery of the status quo of the faculty; on this basis, it seeks to improve and is beneficial to the future development of the departments. A summary of the histograms taken on a department-by-academy basis is shown below:

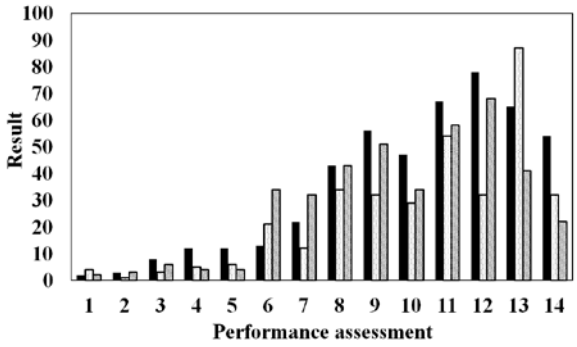

Figure 4 Columns of professors' performance evaluation results in each department

From the bar graph, it can be seen that the overall level of the Department 2 and the Department is 11. Faculty 3, Faculty 5, Faculty 7, Faculty 8, Faculty 9, Faculty 12, Faculty 13 are at intermediate level. In comparison, faculty 1, department 6, and department 14 were poor. In addition, the performance of individual professors in department 4, department 8, department 9 and department 10 is more prominent. At the same time, all the professors have great room for improvement. Compare this result with the actual situation of the school. The Department 2 and the Department 11 are just two strong disciplines in the school. The university's national model teachers, national thousand person plan winners, and national sports teacher are mostly from these two departments. In recent years, colleges and universities have received large funding from teachers in various aspects such as teacher training, discipline construction, and laboratory construction. At the same time, they have also contributed a lot to the school and have already formed a virtuous cycle of development. Faculties, such as Faculty 3, Faculty 5, etc., are just a few of the departments of science and engineering that develop around the backbone of the university. The Department 1, Department 6, and Department 14 are mainly underprivileged disciplines in which the school's network, sports, and public basic courses are located. They rarely intersect with the main disciplines, and the resources and achievements obtained are very limited and they are at a disadvantage in the evaluation results. In the same way, we compare the professors with outstanding performance and the actual situation of the school. Faculty 2 Faculty C and Faculty 11 Faculty B are all teachers with relatively balanced physical education and research development and higher level of scientific research.

The evaluation scores of the two teachers are all above 95 points, and they are also undertaking horizontal research projects while undertaking national research projects. Moreover, the publication of high-level natural science class papers is in full compliance with the positioning of physical education and research-oriented colleges and universities and the goal of building high-level universities. In addition, Faculty 4 Teacher B is a teacher with outstanding performance in physical education. The teacher's evaluation in class is excellent and the results of physical education are abundant. Although the scientific research projects undertaken are only horizontal and relatively low-cost, they can also rank among the top performers in the university's performance rankings. This also shows that higher education institutions are not equal to research institutes. It has a very important duty to educate people. Therefore, teachers who have "trick" in physical education should receive appropriate incentives and commendations. The overall performance evaluation results based on the Balanced Scorecard are as follows:

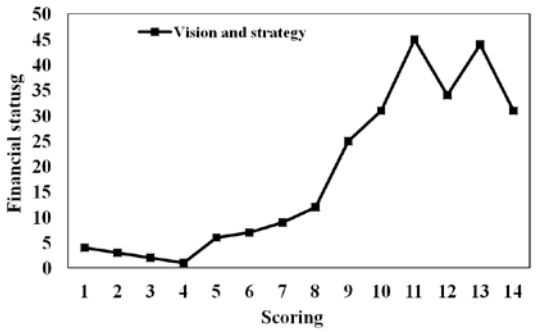

Figure 5 Balanced scorecard

Through the example verification, the fuzzy comprehensive evaluation method can combine all aspects of indicators to get the results of college teacher performance appraisal, and the model we built fits the actual situation of the school. At the same time, the model has certain applicability. In this case, the professor is selected as an example for analysis. The same applies to associate professors, lecturers and other full-time teachers, but it does not apply to teachers in ideological and administrative positions such as counselors and class teachers. And teachers of different titles can't perform performance appraisal at the same time, that is, the model is only valid for teacher performance appraisal of the same job title and cannot be mixed appraised. The comprehensive evaluation weight vector $W=(A,B,C,D)^T$ = (0.3221, 0.1482, 0.3653, 0.1644)T. According to formula $V_i = A_i^T \circ R_i$, the fuzzy comprehensive evaluation value can be obtained, in which the operator uses a weighted average algorithm: V=(0.3481,0.0911,0.1070,0.0362,0.4475). The teacher's comprehensive score is: P=(0.477284,0.101084,0.09342,0.042033,0.304447)*(100 75 50 25 0)T= 47.89878. Due to the complexity of the calculation process, the results of the qualitative indicators of the remaining 40 teachers are not analyzed in detail. For the higher education teachers' performance appraisal, the selected comment set is {excellent, good, medium, qualified, unqualified}, and the corresponding score set is {100, 75, 50, 25, 0}. Select statistical data and colleagues, leaders, students, self-evaluation materials, etc., to make single-factor evaluation on the indicators in the evaluation index system. The semi-trapezoid distribution is used to determine the degree of membership from the previous quarter's quantitative index, and the qualitative index obtains the degree of membership based on the evaluation data statistics. The weight of physical education teaching B2 is W= (B21, B22, B23, B24)T=(0.1082,0.6434,0.1174,0.1310)T. According to formula $V_i = A_i^T$, single factor evaluation values can be obtained, where the operator uses a weighted average algorithm: V_{B2} =(0. 0763,0.1417,0.1000,0.03726,0.6434). Indexes of Physical Education Teaching Achievements under the First Grade Index of Physical Education Teaching. The weights of sports teaching achievements are W = (B31, B32, B33, B34) T= (0.6309, 0.1457, 0.0508, 0.1726) T.

5 Conclusion

College teachers are the main body of knowledge dissemination, scientific research and scientific and technological innovation. They play an important role in national development, personnel training, and scientific and technological progress. The performance evaluation of college teachers has a positive effect on school management, teacher development, and talent training. This article analyzes the meaning, main body, and process of performance appraisal, and discusses four commonly used performance appraisal methods. At the same time, through the analysis of the characteristics and goals of the performance evaluation of college teachers, it is concluded that there are still a series of problems that need to be improved in the performance evaluation of college teachers. Therefore, this paper adopts the fuzzy comprehensive evaluation method for the performance evaluation of college teachers. The use of this method can improve the scientific and fairness of teacher performance evaluation to some extent. The college teacher performance

evaluation model established in this paper is applicable to the performance evaluation of university teachers. It can integrate the teachers' work in all aspects to rank in a single row, breaking the unit barriers in colleges and universities. It also broke the traditional assessment model of physical education teaching and scientific research work. It can solve the problem of over-subjectivity and other disadvantages of traditional university teachers' performance evaluation to a certain extent. It is scientific and innovative. The implementation of the model will provide the necessary basis for the school to formulate policy documents, development plans and other work.

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